

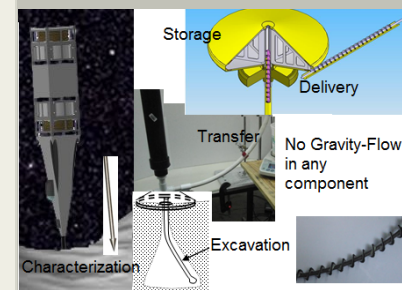
Subsurface Access, Characterization, Acquisition, Transport, Storage and Delivery in Microgravity, Phase I

Completed Technology Project (2014 - 2014)



Project Introduction

This project will develop geotechnical measurements, sample extraction and transport equipment for subsurface regolith on NEOs, asteroids, moons and planets, enabling accurate evaluation of subsurface composition and chemistry. Non-contact measurements can provide preliminary information regarding bulk density and composition; however, more accurate assessment of a bodies' composition and evaluation of potential resources, their abundance and ease of recovery will require physical contact with the surface, and penetration or drilling down to depths that are not subjected to significant space weathering. Such surface-contact and sampling probes will enable physical and chemical characterization of unweathered subsurface material. Inertial and autonomous percussive penetration to depth, along with novel drilling and tailings-transfer approaches, will be developed to both attain the required depth, and to advance semi-autonomous sample-collection/recovery technology so as to minimize the need for operator (or tele-operator) involvement. Both core- and bulk-regolith sampling methods which minimize loss of volatiles, will be developed. To the extent feasible in the laboratory, this project will approximate key features of reduced-gravity conditions both physically and in particle-scale numerical simulations to ensure that the methods developed will function in realistic environments. The primary aim of this study will be advancement of technologies suitable for use on robotic precursor characterization-missions, with the anticipation that further-improved versions of the same methods will minimize the time and effort of human intervention/involvement during follow-on exploration or prospecting missions. In addition, the feasibility of novel extraction, transport, handling, and storage methods for bulk regolith material, which minimize loss of volatiles, will be developed. Such developments will be especially useful for in-situ resource evaluation and utilization.



Subsurface Access, Characterization, Acquisition, Transport, Storage and Delivery in Microgravity Project Image

Table of Contents

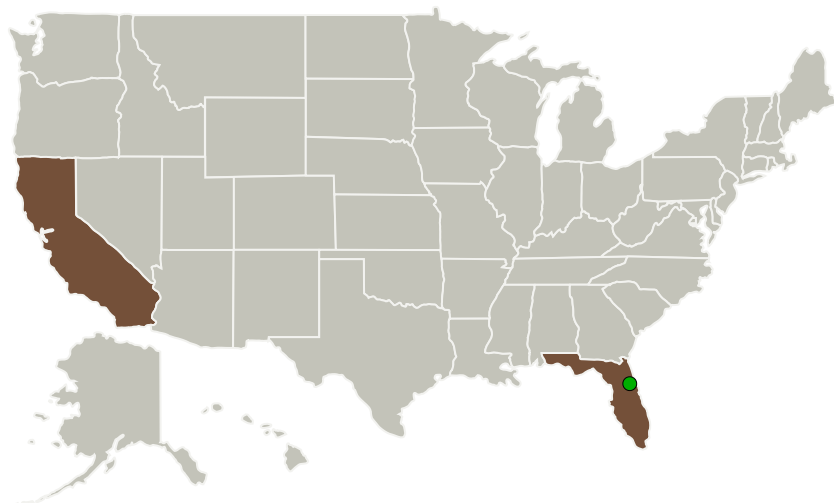
Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

Subsurface Access, Characterization, Acquisition, Transport, Storage and Delivery in Microgravity, Phase I

Completed Technology Project (2014 - 2014)



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Grainflow Dynamics, Inc.	Lead Organization	Industry	Livermore, California
● Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations

California	Florida
------------	---------

Project Transitions

**June 2014:** Project Start**December 2014:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/139494>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Grainflow Dynamics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

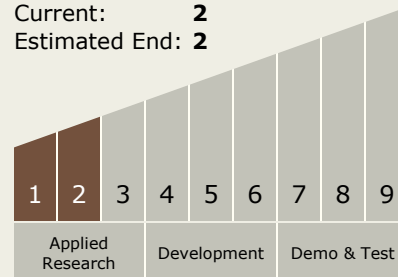
Carlos Torrez

Principal Investigator:

Otis R Walton

Technology Maturity (TRL)

Start: **1**
 Current: **2**
 Estimated End: **2**

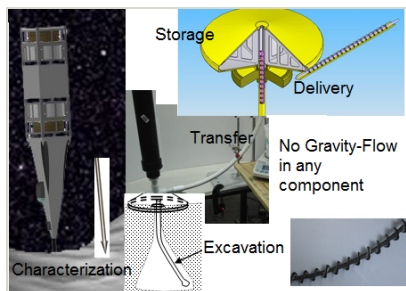


Subsurface Access, Characterization, Acquisition, Transport, Storage and Delivery in Microgravity, Phase I

Completed Technology Project (2014 - 2014)



Images



Project Image

Subsurface Access,
Characterization, Acquisition,
Transport, Storage and Delivery in
Microgravity Project Image
(<https://techport.nasa.gov/image/133409>)

Technology Areas

Primary:

- TX04 Robotic Systems
 - └ TX04.3 Manipulation
 - └ TX04.3.4 Sample Acquisition and Handling

Target Destinations

The Sun, Earth, The Moon,
Mars, Others Inside the Solar
System, Outside the Solar
System